

III-V COMPOUND SEMICONDUCTOR AND ITS MANUFACTURE AND LIGHT EMITTING DEVICE

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Abstract

PROBLEM TO BE SOLVED: To provide a III-V compound semiconductor with very few defects and high quality and its manufacturing method and, further, a light emitting device consisting of the compound semiconductor.

SOLUTION: After trimethyl Ga and NH₃ are supplied onto the mirror-polished C surface of a sapphire substrate 9 at a substrate temperature of 550 deg.C and a GaN buffer layer 8 is formed, the substrate temperature is elevated to 1100 deg.C and silane is supplied to build up an Si-doped n-type GaN layer 5 and, further, nondoped GaN layer 4 is formed at the same temperature. Then the substrate temperature is lowered to 780 deg.C and an In_{0.3}Ga_{0.7}N light emitting layer 1 is built up by using TEG, TMI and NH₃. Further, after TEG, TEA and NH₃ are supplied at the same temperature and a Ga_{0.8}Al_{0.2}N protective layer 2 is formed, the substrate temperature is elevated to 1100 deg.C and an Mg-doped GaN layer 3 is built up. After the III-V compound semiconductor is taken out from a furnace and subjected to a heat treatment in an N₂ atmosphere and the GaN layer 3 is converted into a low resistance p-type layer, positive and negative side electrodes 6 and 7 are formed to obtain a light emitting device emitting clear blue light.

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TI Layered III-V semiconductor structure with high quality and low defect content, esp. for UV or blue light emitting element.

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A new III-V semiconductor structure comprises a stacked layer sequence of

(a) a 5-90 Angstroms thick first layer of a III-V semiconductor of formula $\text{In}_x\text{Ga}_y\text{Al}_z\text{N}$ ($x+y+z=1$, $x, y = 0$ to 6 exclusive; and $z = 0$ to less than 1);

(b) a second layer of a III-V semiconductor of formula $\text{Ga}_x\text{Al}_y\text{N}$ ($x'+y'=1$, $x' = \text{greater than } 0 \text{ to } 1$; $y' = 0 \text{ to less than } 1$); and (c) a third layer of a

III-V semiconductor of formula $\text{Ga}_x\text{Al}_y\text{N}$ ($x''+y''=1$; $x'' = \text{greater than } 0 \text{ to } 1$; $y'' = 0 \text{ to less than } 1$). Also claimed are III-V semiconductor

structures comprising a fifth III-V semiconductor layer and the first, fourth and fifth III-V semiconductor layers and the first layer, and the fourth and fifth layers and the first, second and third layers. Further

claimed are (i) a process for prodn. of a III-V semiconductor structure; and (ii) a light emitting element with a III-V semiconductor structure as

described above.

USE - Used e.g. for UV or blue-emitting LEDs and laser diodes.

ADVANTAGE - The structure has high quality and few defects and allows prodn. of light emitting elements having excellent emission properties.

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